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FUNDAMENTAL SKILLS TRAINING IN THE SAUDI NAVAL EXPANSION PROGRAM: EVALUATION REPORT I

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The development and evaluation of a fundamental skills training (FST) program for enlisted personnel in the Royal Saudi Naval Forces (RSNF) are described. The FST program was 6 months in length and preceded technical training. The goal of FST was to increase the comparability of RSNF and U.S. Navy students in the follow-on "A" school training, where the two groups are integrated. The FST is a multistranded, objective-based, mastery program that teaches the reading, writing, mathematics, science, and study skills prerequisite to "A" school training in the electronics, engineering, seamanship, and clerical strands.

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A pre-FST Saudi group was compared with a cohort of U.S. Navy enlisted personnel. The results indicate that there was an overemphasis on the learning of technical facts at the expense of basic literacy and learning skills. While students had the necessary technical fact prerequisites, they could not effectively generalize that information or acquire and integrate new technical information. The results have been used as a basis for developing a revised curriculum.

FOREWORD

This research effort for the Saudi Naval Expansion Program (SNEP) was performed under reimbursable task order WR 07034. Midway through the program, management and sponsorship were transferred from the Chief of Naval Operations (OP-63C) to the Chief of Naval Material (PM-5).

SNEP includes training of enlisted personnel from the Royal Saudi Naval Force (RSNF). An earlier report prepared for the program sponsor contained recommendations for improving SNEP training; the fundamental skills training (FST) program described herein is an outgrowth of those recommendations. Work under the present task order has focused on the development and administration of the initial FST courses. The work included coordination of the FST effort with other SNEP training programs.

This report describes an evaluation of the FST program designed to provide data for curriculum revisions. This evaluation focused on determining the proper balance between teaching learning skills and technical facts. Initial data on the performance of RSNF students in U.S. Navy Class "A" schools are also provided. Recommendations for curriculum revision are made to the Program Manager, PM-5.

Appreciation is expressed to the Chief of Naval Technical Training and to the staffs of Naval Training Centers at Great Lakes and San Diego for their help in this effort.

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SUMMARY

Problem and Background

Enlisted personnel in the Royal Saudi Navy Force (RSNF) began receiving English language and technical training in the United States in 1974 under the Saudi Naval Expansion Program (SNEP). After receiving initial preparatory training, the RSNF students were integrated with U.S. Navy enlisted personnel for their apprentice and journeyman training. From the beginning, Saudi students experienced high failure rates and frequent disciplinary problems. A fundamental skills training (FST) program was developed and integrated with the Saudi detachment technical training (SDTT) program in 1977. The goal of both programs was to increase the comparability of RSNF and USN students enrolled in U.S. Navy Class "A" technical schools.

The development of the FST program is an iterative process, with SNEP Company 11 receiving the initial version of the curriculum, Company 12 receiving the interim version, and Company 13 receiving the final version. There was a need to obtain post-FST data from the students, instructors, and supervisors of Company 11.

Objective

The objective of this effort was to obtain post-FST interview and test data from Company 11 and to make recommendations for revisions to the FST curricula based upon those data. This report documents the analyses and rationale underlying the revision recommendations.

Approach

RSNF students from SNEP Company 11 and a comparable USN cohort were interviewed and tested at two points in their follow-on training. Instructors and supervisors were also interviewed. Testing included the administration of basic skills test batteries to determine specific basic skill achievement.

Findings

The interview and test data suggest that the FST and SDTT courses overemphasized the learning of technical facts and underemphasized basic literacy and learning skills. The Company 11 students performed well in the follow-on schools only as long as instruction was on technical facts that had been pretaught in the FST and SDTT preparatory courses. Performance fell significantly when the application or generalization of information was required, or when new topics were introduced.

In the interviews, Company 11 students in the electronics and engineering strands were reported to be superior to prior RSNF students. However, it was found that much of the curriculum of these schools was pretaught in either the FST or SDTT preparatory courses.

The Company 11 students performed well below the USN cohort in reading and notetaking. Their performance was generally comparable to the USN cohort in the areas of mathematics and knowledge of technical subjects. Instructors recommended that reading and study skills be given greater emphasis in the next version of the curriculum.

Conclusions

1. The FST and SDTT programs improved the initial "A" school performance of engineering and electronics students and, in some instances, resulted in full comparability with USN student performance. The performance of seamanship students in Operations Specialist (OS) Class "A" school, however, was not improved.

2. The initial "A" school successes seem to have been due to pre-teaching of the materials covered in the school. Performance declined when new learning, application of facts, or generalization was required.

3. The primary RSNF student deficits were in the literacy and learning skills associated with notetaking and reading.

4. The Saudi students did not encounter unique problems in the self-study situation. They neither favored the self-study approach nor did they view it as something to avoid. Using the self-study approach did reduce the requirement for notetaking, an area in which the RSNF students were particularly weak.

5. Training aids that reduce basic skill requirements should be used whenever possible in follow-on instruction. The Arabic-to-English dictionaries developed by the Saudi Liaison Office, Great Lakes, and the use of tape recorders in the classroom, are two such aids.

6. All-Saudi classes were viewed as detrimental to learning by both instructors and students. The formation of all-Saudi classes in OS "A" school, while necessary because of security requirements, very likely contributed to the poor performance of the OS students.

Recommendations

The revisions called for will require a major curriculum redesign effort. The specific recommendations to PM-5 are as follows:

1. Both the FST and SDTT programs should be revised. Since course length cannot be extended, the revision process should begin with the elimination of technical topics that have only limited use in follow-on instruction.

2. The extent to which FST instruction will generalize to new learning situations should be increased for all strands. This should be accomplished by raising the level of the learning objectives from the memorization of facts and procedures to the level of learning concepts and solving problems (i.e., to using technical knowledge and basic skills).

3. The amount of instruction time spent on reading and notetaking should be increased. This instruction should emphasize methods of rapidly locating and abstracting information from text and lectures.

4. Instruction in learning skills and strategies should be increased by embedding them in the technical problem solving objectives and in the instruction on basic literacy skills.

5. The English-to-Arabic dictionaries developed for the engineering and electronics strands should be utilized more extensively. The dictionary development effort should be expanded to cover all follow-on "A" and "C" schools.

6. To reduce the notetaking requirement, students should be provided with cassette recorders to record "A" school lectures.

7. At the end of FST, electronics students should be instructed in the use of the audio-visual equipment available at the Basic Electricity and Electronics (BE/E) School in San Diego. A visit to the BE/E school should be included.

8. The mathematics requirements of the engineering and seamanship "A" schools should be reviewed to determine whether or not the mathematics instruction given to these strands should be eliminated or reduced.

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INTRODUCTION

Problem

Enlisted personnel in the Royal Saudi Navy Force (RSNF) began receiving English language and technical training in the United States in 1974 under the Saudi Naval Expansion Program (SNEP). After receiving initial preparatory training, the RSNF students were integrated with U.S. Navy enlisted personnel for their apprentice and journeyman training. From the beginning, Saudi students experienced high failure rates and frequent disciplinary problems. A fundamental skills training (FST) program was developed and integrated with the Saudi detachment technical training (SDTT) program in 1977. The goal of both programs was to to increase the comparability of RSNF and USN students enrolled in U.S. Navy Class "A" technical schools.

The development of the FST program is an iterative process, with SNEP Company 11 receiving the initial version of the curriculum, Company 12 receiving the interim version, and Company 13 receiving the final version. There was a need to obtain post-FST data from the students, instructors, and supervisors of Company 11 before Company 12 entered FST.

Objective

The objective of this effort was to obtain post-FST interview and test data from Company 11 and to make recommendations for revisions to the FST curricula based upon those data. This report documents the analyses and rationale underlying the revision recommendations.

Background

SNEP was designed to meet the personnel demands created by a major RSNF ship acquisition program and by the expansion of shore-based RSNF facilities. The SNEP training will be conducted in the United States until approximately 1983, when it will move to newly constructed training facilities in Jubail, Saudi Arabia.

The typical SNEP student is a 17-year-old male who has completed the ninth year of school in Saudi Arabia and understands virtually no English. The primary goal of SNEP is journeyman-level proficiency in various electrical, electronic, and engineering fields, although some students are trained in clerical skills. In the original training pipeline, the preparatory training consisted of approximately 1 year of English language instruction at the Defense Language Institute, 3 months of recruit training, and 4 months of technical science training. In this training, classes consisting of all Saudi students were formed. However, for apprenticeship and journeyman training ("A" and "C" schools respectively), the students were integrated, typically as a minority, with USN students.

The training of RSNF personnel was characterized by high failure rates and frequent disciplinary problems. In May 1976, the Commander of RSNF asked NAVPERSRANDCEN to conduct a "needs-analysis[1]" of these problems.

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[1]Navy Personnel Research and Development Center. Enlisted technical training in support of the Saudi naval expansion program: A needs analysis. October, 1976.

The needs-analysis identified two major problems. The first was that the 4 months of preparatory technical training given to incoming RSNF students was not sufficient to fill the gap between their knowledge of science and mathematics when entering the program and the level of knowledge required for success in U.S. Navy Class "A" schools.

The second problem was that the RSNF students did not understand the U.S. educational system and did not have the basic skills required for success within the system. In the Saudi school system, the student is expected to learn verbatim all that he reads or is told. A good lecturer is one that dictates notes. In addition, all tests require a written response; multiple-choice and true-false testing are unknown. As a result, Saudi students have difficulty in locating, abstracting, and summarizing information, and in identifying key points. They do not have the American student's knack of "studying for the test."

Both of these problems were compounded by inadequate language skills; it was difficult for RSNF students to complete reading assignments, write notes, keep up with the pace of the lectures, or even to understand the various dialects encountered in lecture instruction. The RSNF students performed at the fourth grade level on an American-normed reading test (see footnote 1). Thus, the students were at a clear disadvantage when they were integrated into a classroom with American high school graduates reading at the eleventh grade level (Duffy & Nugent, 1978).

The needs-analysis recommended the development of the FST program as a solution to the two major problems cited above: lack of science training and inadequate learning skills. The Commander of RSNF, upon reviewing the needs-analysis, recommended that the training pipeline be modified to include the proposed FST program.

The modified pipeline is shown in Figure 1. The Defense Language Institute training, which required approximately 1 year, was to an English comprehension level of 70 and focused on oral language skills. The needs-analysis found the graduates of this program to have reading skills of about the fourth grade level and listening comprehension skills of about the ninth grade level. The Saudi detachment technical training (SDTT) is basically the same as the preparatory technical training in the original pipeline. The curriculum, however, underwent some revision and was taught on a shared-time basis with FST II. The two leave periods were required to ensure that all students returned to Saudi Arabia at least once per year.

English Language Requirements

SNEP training is in English, not only because the training is being conducted in the United States, but also because English is the language used by the RSNF. All technical documentation will be in English, and oral communications to and from the shipboard command and control centers are expected to be in English.

The burden created by the necessity of teaching complex technical material in a language that is foreign to the students is obvious. Using Arabic, however, would require the translation of all printed materials. It can be argued that the effort required to do so would be far greater than the effort required to teach the entire RSNF to speak English. The amount of documentation supporting military equipment has grown so large that 280,000 pages of technical documentation are required to support the operation and maintenance of a single modern aircraft (Muller, 1976). Thus, the initial translation would require a massive and continuous effort over a period of several years. Furthermore,

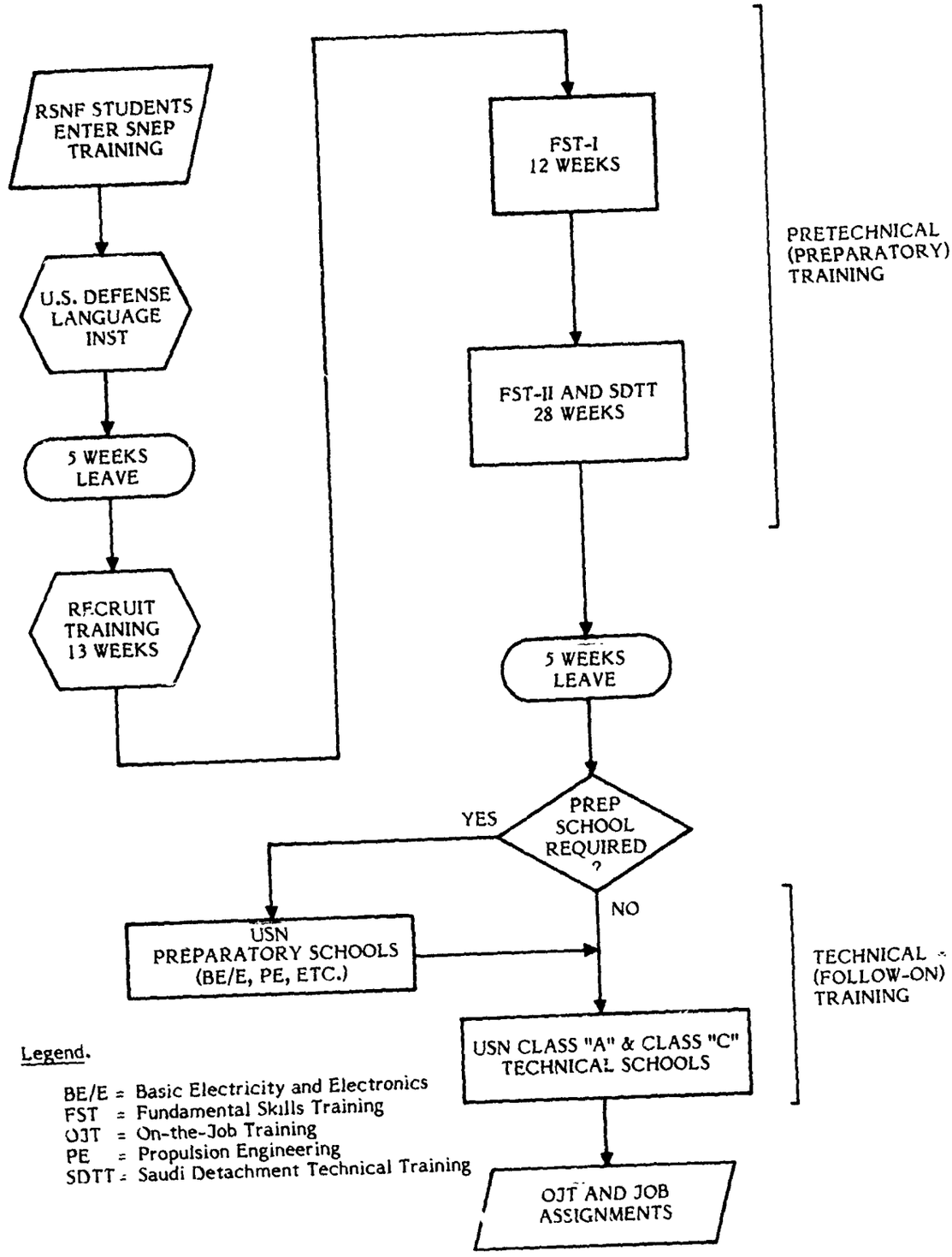

Figure ... Training pipeline for RSNF students in SNEP training.

technical manuals are updated frequently, and the ongoing translation of change and revision notices would be a large task without any determinable end.

For complex equipment, few people outside of the engineers at the manufacturer's facility have the competence to validate even the English language documentation. To achieve accurate translations would require large numbers of personnel who are competent both in translating and in the particular technical areas, and these people simply do not exist.

It has also been argued that the materials could not be translated because Arabic is not a technical language. In particular, it has been argued that large numbers of technical words do not occur in Arabic and thus would have to be carried over in the English language. Availability of the proper vocabulary may not be a serious problem, however, since science subjects are successfully taught in Arabic. There are words in Arabic for "transistor," "resistor," and many other technical terms.[2] A more important problem may be the tense structure of the Arabic language. There are only two tenses in Arabic, one to indicate past or present and one to indicate present or future (Patai, 1973). In addition, time tagging (i.e., relating the occurrence of one event to the time of occurrence of another event) does not generally occur in Arabic. The restriction in tenses, the overlapping use of tenses, and the lack of time tagging would all make it very difficult to describe complex sequences or to make time-based conditional statements. Both of these are essential in documenting operation and maintenance procedures.

FUNDAMENTAL SKILLS TRAINING: DEVELOPMENT AND EVALUATION

This section describes some of the principal considerations in the design of the FST-I and FST-II curricula and outlines the development and evaluation plans for the FST program.

Selection of Strategies for Increasing Learning Skills

Recent educational research has focused on two primary strategies for increasing learning capabilities. The first concentrates upon increasing the students' knowledge of the particular subject area (Rumelhart & Ortony, 1977; Winograd, 1977). There is strong evidence that people use their knowledge of a subject to organize and interpret new information in the same subject area. Thus, the greater their store of relevant knowledge, the more effective will be their learning of new information in the area.

The second strategy for increasing learning capabilities deals more directly with teaching the student how to learn (Brown, Campione, & Day, 1981; Tuma & Reif, 1980; O'Neil, 1979). Here the focus is not on increasing the student's knowledge of the content area, but on affecting how the student interacts with and processes that information. This includes strategies for memorizing, organizing, generalizing, abstracting, and summarizing information. The strategies are very diverse and depend, in part, on the subject matter.

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[2]The argument of unavailable vocabulary is one frequently advanced by personnel associated with SNEP. An instructor at ARAMCO, Dahahran, Saudi Arabia, where English is the language of use, provided the counter argument and these examples. We thank the ARAMCO instructional staff for their assistance.

In the FST and SDTT programs, the view was taken that neither of these approaches would be effective in isolation. The students were extremely deficient in both the knowledge of science relevant to their technical areas and in the learning strategies necessary for education in America. Instruction in the technical area alone would have been insufficient because the students did not have the learning strategies necessary for organizing new information and incorporating it into their new knowledge structure. Instruction only in learning skills would leave the students so far behind the USN students at entry into "A" school that keeping up, even with effective learning skills, would be impossible.

The Goals of FST-I and FST-II

The goal of the FST program is to increase the comparability of RSNF and USN students in U.S. Navy "A" schools. The goal of FST-I is to develop those skills that are fundamental to virtually all follow-on training. The goal of FST-II is to prepare the RSNF students for the specific reading, writing, study skill, and mathematics requirements of SDTT and the follow-on schools.

Curriculum Development and Evaluation Plan

The overall plan for developing and evaluating the FST curriculum is shown in Figure 2. The research and development phase includes the initial curriculum development and two revision cycles. Company 11 received the initial FST and SDTT curricula, Company 12 will receive interim versions, and Company 13 will receive the final versions. Because of the short development time (task analysis began 7 months before the arrival of Company 11 students) and the large amount of material (2280 hours of instruction) to be developed, it was anticipated that major revisions to the curricula would be necessary between Companies 11 and 12. The revisions to be made between Companies 12 and 13 should be minimal.

Development of Initial FST-I and FST-II Curricula

In September 1977, Northrop Worldwide Aircraft Services, Inc. (NWASI) was contracted to develop the FST-I and FST-II curricula, teach the first class of students (Company 11), and revise the curricula as evaluation data dictated. The curricula, which were revised after Company 11 had progressed to the follow-on schools, are currently undergoing yet another revision.

The curriculum design incorporated a mastery learning approach wherein students were to demonstrate mastery of each major enabling objective before progressing. Circumstances dictated, however, that their instruction be group-paced, with instruction delivered primarily by an instructor. The conflict between mastery learning and group pacing was resolved by providing 2 hours per day, 4 days per week, for remediation and retesting. If a student failed to demonstrate mastery, he usually received remediation and retesting at the end of that day. Virtually all tests were multiple-choice, with a mastery criterion of 70 percent.

FST-I consisted of 360 hours of instruction presented over 12 weeks. All students received the same instruction. The topics of instruction are presented in Table 1 along with the number of major enabling objectives (i.e., mastery requirements) and the instructional hours.

FST-II was taught by NWASI personnel in conjunction with SDTT. (SDTT was taught by USN instructors.) Each course consisted of 14 weeks of instruction, taught on an

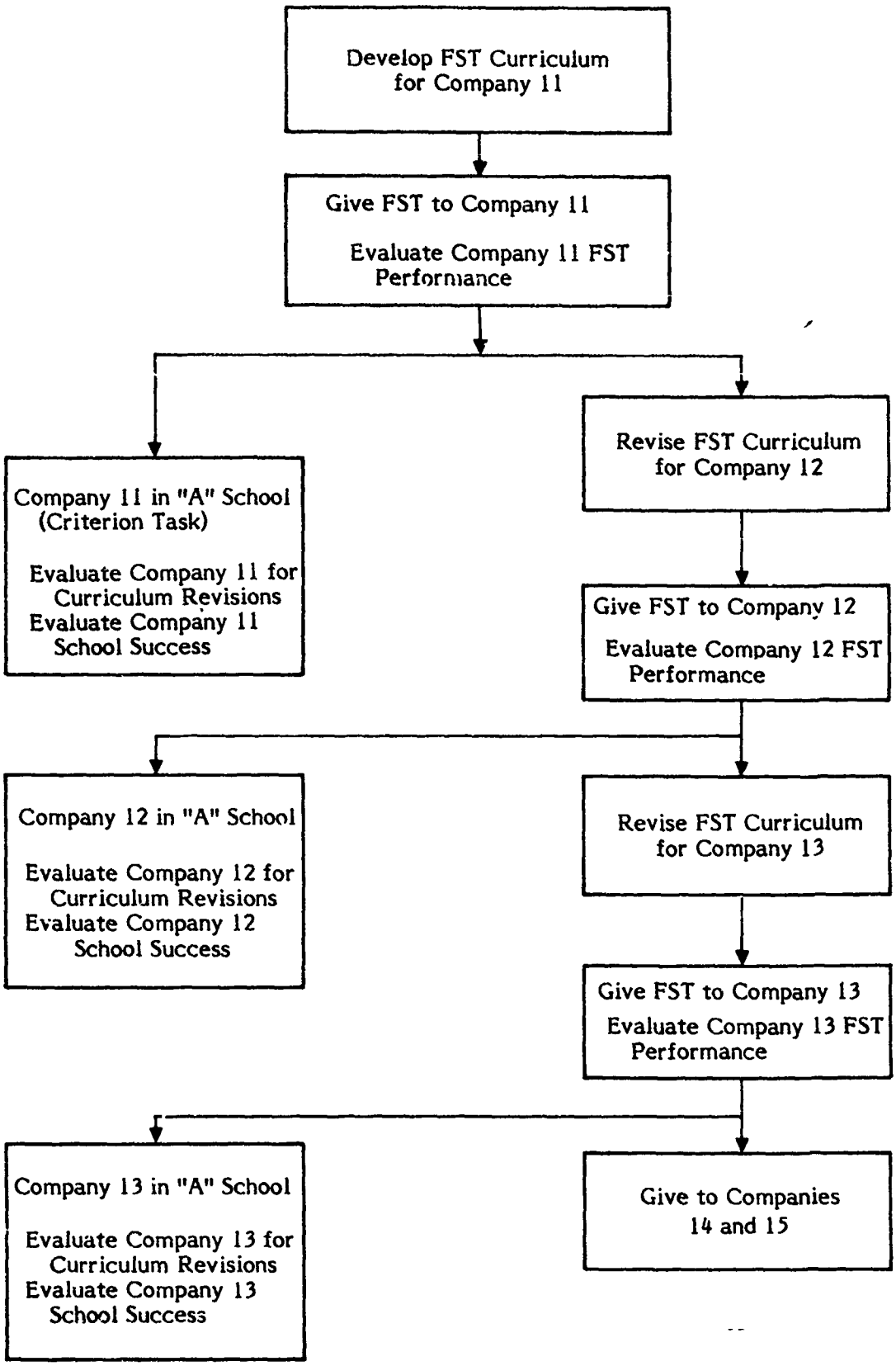

Figure 2. Overall design of curriculum development and evaluation.

Table 1

Topics Taught in FST-I

Topics	Number of Major Objectives	Hours of Instruction
Writing Skills	3	28
Basic Study Skills	5	32
Reading Skills	4	58
Basic Mathematics I	12	95
Basic Mathematics II	5	25
Basic Physical Science	7	60
Hand Tool Science	5	23
Earth Science	4	20
Drawings and Diagrams	4	17
Totals	49	358

integrated schedule over 28 weeks. Both FST-II and SDTT addressed the preparatory training requirements needed for "A" school training. The courses were divided into five strands: electronics, engineering, seamanship, clerical-storekeeper, and clerical-yeoman. The language training was identical for all strands.

Many of the FST-II objectives were technical training objectives. The training under these objectives was primarily at the definitional and concept level and prepared the student for the more technical and laboratory-based coverage of the topic in SDTT. The FST-II topics for each strand are presented in Table 2.

Evaluations

Student performance was evaluated during FST and in the follow-on schools, and will be examined after several companies have completed "A" school. Data from early versions of the FST were used to make revisions to the curricula. Data gathered from "A" Schools will be used to determine the success of the program. "A" school performance will be the criterion task for evaluating the overall program, since the program's goal is to improve the performance of RSNF students in Class "A" schools.

Evaluating Early Versions of the FST Curricula

The kinds of data to be used in revising the early versions of the FST curricula are listed in Table 3. First, data collected during FST provided detailed recommendations at the level of the major and minor enabling objectives. The course of instruction as defined by the major enabling objectives has been accepted as appropriate. The evaluation, then, focused on the effectiveness of the particular instructional strategies used to achieve the objectives. The early post-FST assessment focused on assessing levels of competency in

Table 2

Topics Taught in FST-II

Topic	Number of Major Objectives	Hours of Instruction
Electronics		
Language	3	53
Applied Mathematics	4	15
Electrical Science	2	15
Principles of Electricity	2	22
Direct Current Principles	9	88
Alternating Current Principles	8	88
Vacuum Tube Principles	6	39
Electromagnetic Wave Theory[a]	8	69
Solid State Principles	6	67
Test Equipment	3	22
Superheterodyne Receiver	3	12
Total	54	490
Engineering		
Language	3	54
Applied Mathematics	4	23
Machinery Science	5	54
Drawings and Blueprints	3	42
Tools and Uses	4	68
Damage Control	5	24
Auxiliary Machinery	8	73
Internal Combustion	4	62
Total	36	400
Seamanship		
Language	3	63
Applied Mathematics	4	24
Rating Group	1	18
Seamanship	5	75
Lookouts	2	11
Safety and Rescue	2	22
Gunners	3	25
Damage Control	5	28
Navigation	9	89
Signaling	4	27
Combat Information	3	42
Total	41	424
Clerical-Yeoman		
Language--Yeoman	4	81
Naval Organization	2	26
Subject Classification System	4	35
Administrative Function	2	17
Enlisted Personnel Service Records and Reports	6	49
Officer Personnel Service Records and Reports	3	35
Mail Handling/Records Management	2	28
Security Procedures	1	34
Personnel Accounting and Diary Procedures	3	48
Naval Correspondence/ Correspondence Management	7	57
Total	34	410
Clerical-Storekeeper		
Language--Storekeeper	3	82
Naval Organization	2	26
Administrative Functions	2	17
Subject Classification System	4	35
Supply Department Responsibilities	2	18
Material Identification	8	74
Inventory Management	3	33
Procurement	6	28
Receipts, Custody and Stowage	4	30
Material Expenditure	4	44
Total	40	409

[a]This topic is taught to Radiomen only.

Table 3

Sources of Evaluation Data for Curriculum Revision

Group	During FST	Post-FST
Companies 11, 12, & 13	• Test performance • Instructional consistency/adequacy questionnaire[a] • Instructor comments • Class observations • Curriculum review comments • Counselor reports • Reports from SDTT instructors[b]	• Interviews • Basic skill test batteries
USN Cohort		• Interviews • Basic skills test battery

[a]The instructional consistancy/adequacy questionnaire is given to both students and instructors after each mastery test.

[b]The details of this part of the evaluation plan are described in the Evaluation Plan, developed under contract data item B019, contract N00123-77-c-0793.

the basic skills. The validity of the basic skill specifications, and the degree of achievement in each basic skill, were also determined.

The post-FST assessment was conducted approximately 1 month after entrance to "A" school. All students were given a basic skills test battery that assessed their competency in each basic skill and knowledge area taught in FST. Also, interviews were used to: (1) obtain instructor judgments on areas of improvement relative to other companies, (2) obtain instructor and student comments on skill deficiencies and FST relevancy, and (3) see if U.S. Navy students are reporting the same kinds of problems as are the SNEP students.

A USN cohort served as a comparison group. Comparison with the USN cohort indicated the degree to which the instructional goal of the FST program, comparability with USN students, was achieved. That is, if the RSNF students have "A" school relevant skills comparable to those of the USN cohort, then failure to achieve comparability in "A" school performance must be due to factors other than basic skill deficiencies. A sample of USN students attending "A" schools with Company 11 students will serve as the USN cohort for Companies 12 and 13 as well.

Ideally, Company 10 would have also been used as a comparison group. Such a comparison would have indicated the degree to which FST improved the RSNF students' mastery of basic skills. Unfortunately, Company 10 students have long since passed the point in "A" school at which the post-FST assessment would have been administered to the

FST Companies. Thus, Company 10 could not be included in this portion of the evaluation. However, "A" school instructors were asked to compare the later companies with Company 10, thus providing some judgmental data.

Evaluating the Overall Program

As was shown in Figure 2, the success or failure of RSNF students in "A" school will not provide information quickly enough to be of value in revising the FST curriculum. Thus, "A" school success/failure data can only provide guidance for continuing or ending the FST program, and then only after one or more additional classes have been taught. Utilization of the success/failure data will be further complicated to the extent that the FST curricula are revised. If the curricula are drastically altered between Companies 11 and 12, or between 12 and 13, then the performance of these three companies in "A" school would only hint at the success of the overall FST program, and the program evaluation would have to await the assessment of Company 14.

Table 4 provides a summary of the design and dependent variables to be used in the overall program evaluation. The "A" school performance of Company 10, the last company before FST was introduced, was the baseline for judging subsequent companies. Pre-FST training measures were used to assess the initial equivalence of the groups. The pre-FST performance of Companies 10 through 13 will be evaluated to find out whether Companies 11, 12, or 13 might have more capable or more motivated students who would outperform Company 10 students even without FST training.

Table 4

Design and Dependent Variables for the Program Evaluation

Group	Pre-FST (Baseline)	"A" School (Criterion)
Company 10	• Defense Language Institute • Recruit training	• Weekly scores • Class standing • Setback/attrition • Time for self-paced courses
Companies 11, 12, & 13	• Defense Language Institute • Recruit training	• Weekly scores • Class standing • Setback/attrition • Time for self-paced courses
USN Cohort		• Weekly scores • Setback/attrition • Time for self-paced courses

The "A" school performance of each company will also be compared to the performance of a U.S. Navy cohort. Ideally, the RSNF students, after successful acquisition of basic skills, should perform at the same level as the USN students. Realistically, equivalency is not expected simply because of the variety of other differences in the SNEP and U.S. Navy programs (see footnote 1). However, the USN cohort will provide a second point from which to judge the relative success of the FST training.

Saudi Detachment Technical Training (SDTT)

While one of the goals of FST instruction was to prepare students for SDTT, performance in SDTT is not part of the overall program evaluation. The preparatory training program given to Company 10 was extensively revised as it was transformed into the SDTT program given to Company 11. Because of these changes, a meaningful comparison cannot be made of the SDTT performance of Companies 10 and 11. However, reports from instructors on the performance of Companies 10 and 11 in SDTT is used as a data source for revising the FST curriculum.

APPROACH AND RESULTS

The previous section described the development, evaluation, and revision plan for the FST program. This section describes an evaluation of the initial FST curricula administered to RSNF Company 11. The evaluation provided the data used in revising the curricula for Company 12.

Interview and Test Sessions

Two interview and test sessions were conducted. The first was conducted during the first month of follow-on training with engineering and electronic students from SNEP Company 11, their instructors, and their supervisors. The second included seamanship students as well as those in engineering and electronics. The interviews were open ended, focusing on aspects of training that students found especially difficult or especially easy. After an open discussion, difficulties in reading, vocabulary, study skills, mathematics, and technical requirements were probed directly. Instructors and supervisors were asked to compare the Company 11 students to previous SNEP classes in terms of their academic skills and disciplinary problems.

At the end of the first interviews, several students were given reading tests. The students were chosen unsystematically, and were individually tested on a short (approximately 100 words) segment of text from their training manual. Students were to (1) read the text aloud, (2) define three to six words selected by the tester, and (3) answer two or three verbatim comprehension questions. The text was available to the student during the test.

The second interview and test session was conducted after approximately 10 weeks of training in one or more of the follow-on schools. The Company 11 students, their instructors, their supervisors, and a cohort of USN students were interviewed, following the same procedure used in the first interview and test session. Following the interviews, a 2-hour basic skills test battery was administered to Company 11 and USN students in two 1-hour sessions, either in the morning and afternoon or on successive days. USN and Company 11 students were tested at the same sessions.

Subjects

All available Company 11 students, with the exception of storekeepers (N = 2), were interviewed and tested. (It was felt that with only two students in the clerical-storekeeper strand, a reliable evaluation of the training effectiveness could not be obtained.) The numbers of students and instructors interviewed and tested at each follow-on school are shown in Table 5. Between the first and second interview and test sessions, many electronics students had moved from Basic Electricity and Electronics (BE/E) school to one of the "A" schools, and some engineering students had moved from Propulsion Engineering Basics (PE) school to Engineman (EN) "A" school. Only 36 (81.8%) of the possible 44 students were available for the first interviews, while 100 percent were available for the second session.

Table 5

Numbers of Students and Instructors Interviewed and Tested

Strand/School	First Session			Second Session		
	Company 11 Students		Instructors Interviewed	Students Interviewed & Tested		Instructors Interviewed
	Tested	Interviewed		Company 11	USN	
Electrical/ Electronics						
BE/E	7	26	8	20	12	4
FT	--	--	--	5	31	4
GM	--	--	--	2	8	6
Engineering						
PE	5	10	5	--	--	--
EN	--	--	--	8	27	5
Seamanship						
OS	--	--	--	14	6	1
Total	12	36	13	49	84	20

Note. In addition to the subjects listed above, supervisory personnel consisting of the Director of the Foreign Student Office, a representative of the RSNF Liaison Office at Great Lakes, and officers at the "A' schools (as available) were interviewed each time.

Instructors and USN students to be interviewed or tested were selected by the Officer-in-Charge at the schools. Instructors were requested who had the most Company 11 students in their classes and who had experience with prior RSNF classes. At each school, a sample of 10 to 15 USN students was requested who (1) were at the same point in training as the Company 11 students and (2) had a composite test aptitude composite

score that just met the entry requirements for the school. The purpose of this sampling restriction was to obtain students who were eligible for the school (and thus likely to succeed), but who were not overqualified. The basic skill levels of these USN students represent the goal or standard of the FST training. As shown in Table 5, more than enough students were provided. However, most schools did not know the entry qualifications of their USN students at the time of interview and testing. Therefore, all USN students provided by the schools were tested and their qualifications for entering the school were determined later, when their Armed Services Vocational Test Battery (ASVAB) scores were obtained. Consequently, while they were at the same point in training as the Company 11 students, the USN students represented a wide range of aptitudes.

Basic Skills Test Batteries

Different but parallel basic skills test batteries were developed for the electronics, engineering, and seamanship strands. The batteries were parallel in that each assessed the same seven basic skills. They differed in that, for each technical area, school relevant material was included. The seven tests in each battery were:

1. Reading-to-Learn. A reading test designed to assess functional reading skills required in the classroom. Two passages of approximately 150 words each were selected from unencountered training material in the student's rating area. Students studied the first passage for 6 minutes. The passage was then removed and the student was asked four short-answer questions about what had been read. This procedure was then repeated for the second passage.

2. Reading-to-Do. A 12-minute test of reading skills called for on the job or in the laboratory, where text is used to find the answer to specific questions. Two passages of approximately 150 words were selected from unencountered training materials in the students rating area (BE/E for electronics, PE for engineering, and quartermaster for seamanship). For each passage, students were given 6 minutes to find the answer to four short-answer, factual questions.

3. Technical Vocabulary. A 5-minute, 10-item test in matching frequently used technical words with definitions. A different set of words was used for each technical area.

4. General Vocabulary. Two parts, each 5 minutes long and consisting of 10 matching items. Part 1 involved verbs and their definitions, and Part 2 involved adjectives, adverbs, nouns, and their definitions. The words were all pretechnical and common to all ratings. The same test was used for all technical areas.

5. Mathematics. A 30-minute test consisting of multiple-choice and short-answer questions. The test given to engineering and seamanship students sampled their knowledge of junior high school topics ranging from arithmetic to basic geometry, algebra, and scientific notation. The test for electronics students sampled the algebra, scientific notation, and trigonometry skills required in BE/E and the "A" schools.

6. Notetaking. Students were required to take detailed notes on a 10-minute tape-recorded passage presented at 125 words per minute. This is the only test in which the content was not relevant to a technical area. Time did not permit the development of a content relevant to each technical area. Instead, a passage used in previous research (Aiken, Thomas, & Shennum, 1975) on the characteristics and habits of sharks was presented. This passage was originally developed to be highly organized and of interest to

U.S. Navy recruits. While it would have been better to have had a technically relevant passage, the use of high interest material that lends itself to structured notes was considered an adequate substitute. At worst, the test used here might overestimate the students' ability to take notes in the less organized setting of a classroom presentation.

7. Preparatory Technical Knowledge. A 30-minute test consisting of multiple-choice and short-answer items. The test assessed topic areas in the relevant strands of FST-II and SDTT and is called "preparatory technical" to distinguish it from any assessment of "A" school knowledge.

Basic Electricity and Electronics (BE/E) School

Overview

The BE/E school provides training in the basic skills and knowledge needed by students entering Fire Control Technician (FT) Class "A" school, Gunner's Mate (GM) Class "A" school, and other Class "A" schools not covered by this report. Company 11 electronics students were interviewed and tested during the first month of BE/E and again, about 2 months later, when they were in the last 2 weeks of BE/E or just beginning "A" school.

BE/E School Curriculum. BE/E is a self-paced course consisting of 25 modules. Expected completion time was approximately 11 weeks for Company 11 students and 8 weeks for USN students. These projections were based on a detailed analysis of the progress of prior students. RSNF students who are scheduled to enter GM "A" school take only the first 12 modules and are expected to complete them in approximately 8 weeks.

Instructors described the first 14 modules of BE/E as being primarily fact-learning. All tests are multiple-choice and it would appear that little understanding is required beyond that needed for memorization. On retests (after a failure and subsequent remediation), the large majority of items are reported to be verbatim repeats or paraphrases of the original test items. In contrast, the emphasis in Modules 15 to 25 is on applying facts to laboratory problems such as troubleshooting. Laboratory test items are diagnoses of faults, not multiple choice questions. The instructors confirmed that the application of knowledge gives all students difficulty. They also reported that RSNF students, including those in Company 11, experienced significantly more difficulty than did the USN students.

BE/E Completion Time Standards. For each module, all USN students must meet a completion time standard that is based upon the average time spent on that module by previous USN students having the same entry scores. The time standards for SNEP students are not individualized; they are the same for all students in the company. They are derived by multiplying the average completion time of prior USN students by a constant.

Typically, the expected completion time for successive groups changes only slightly. However, shortly before Company 11 began BE/E, the BE/E curriculum had been revised and USN students were taking much longer to complete the course. When their completion time was multiplied by the SNEP time constant, the time allowed for Company 11 was clearly excessive. The multiplier was subsequently reduced. However, there was a significant delay between forwarding the new standards to supervisory and instructor personnel and entering the change into the computer for feedback to the students.

BE/E Interviews

The BE/E interviews must be interpreted in the context of the administrative adjustment of the time standard. At the time of the first interview, none of the students from Company 11 had completed more than seven of the 25 modules. At the second interview, about a third of the students had completed BE/E school and the rest were in the last half of the course. In both interviews, instructors described the Company 11 students as being better than students from prior SNEP companies in school performance, basic skills, and technical knowledge. In the first interview, they were described as being "far superior" to previous RSNF students. The instructors' judgments were based on the kinds of questions the students asked, how well they understood explanations, and their performance in supervised laboratory exercises. The instructors and supervisors also judged the Company 11 students by their success in meeting the school's completion time standards.

The instructor and student judgments of performance tracked with the changing of the completion time standard multiplier. In the first interview, instructors reported that the Company 11 students were far ahead of schedule and that their performance was comparable to that of the USN students. The students reported that the curriculum was easy, and they were proud to be so far ahead of schedule. At the second interview, instructors reported that student progress had slowed significantly. Most of the students claimed that they were on schedule but recognized that they were judged to be doing poorly. This was probably during the period when the school had adapted the new standard but the larger multiplier was still being used in the computer. Extreme concern was voiced over the failure of many students to meet the expected completion times.

In brief, it is not possible to tell whether the students were in fact having great difficulty with the last half of the course, or whether student performance was adequate and the instructors had simply failed to compensate for the revised completion time standard multiplier. Further complicating the matter is the fact that the multiplier is a matter of the judgment of subject matter experts. Several other factors that could have reduced student performance during the period between the first to second interviews were: a reduction in the number of instructors, changes in instructors, USN student disturbances at the training center, promotion delays, and changes in the curriculum. Because of these factors, the performance of Company 11 students cannot be judged until they have all finished BE/E school and their completion times can be compared with those of the USN cohort.

Although the interview data cannot be used to evaluate the effectiveness of the FST program, it can be used to identify specific student difficulties. Company 11 students reported that the second half of BE/E, Modules 15 through 25, was more difficult because of troubleshooting and laboratory requirements that emphasized application and generalization of knowledge. The USN students, on the other hand, reported that their main difficulty was in understanding Modules 1 through 14 well enough to apply them in the later laboratory sessions.

RSNF students reported that their greatest difficulties were in vocabulary knowledge and reading comprehension. They anticipated that notetaking would be a serious problem in "A" school. In technical areas, they reported difficulty with Module 24, Wave Shaping, the only module not pretaught in SDTT.

Recommendations of BE/E Instructors and Students. Both students and instructors were asked to recommend specific improvements in FST and SDTT. The instructors recommended greater emphasis on reading, study skills, and the writing skills needed to

complete laboratory sheets. The students felt that more training in trigonometry and scientific notation was needed. They also recommended increased emphasis on troubleshooting, and more consistency between SDTT and BE/E equipment.

BE/E Reading Comprehension Test

At the time of the first interview, reading comprehension skills were assessed by asking each of seven students to read aloud a 150-word passage from the training text and then to answer verbatim comprehension questions. The reading rates and comprehension levels are shown in Table 6. Their mean reading rate, 94 words per minute (WPM), can be compared to the 125 WPM rate at which speech is delivered in the U.S. More important than speed, however, are the kinds of errors made by a reader. For this sample, there was a high inverse relationship between reading speed and the frequency and severity of reading errors. The student who read at 150 WPM pronounced most words correctly, his word substitutions were usually correct grammatically, and his pauses were appropriate to the punctuation. In contrast, the students reading at 65 WPM would frequently read through sentence and phrase boundaries in such a way that meaning was either lost or severely distorted. These students read haltingly and mispronounced most content words. Word substitutions that were neither grammatically nor semantically appropriate were given for approximately one fifth of the content words.

When the student had finished reading, the tester pronounced several words and asked for their definitions. This was done to determine the extent to which the reading errors represented difficulties in decoding or in "sounding out." The words were chosen from those that the student either could not pronounce or for which he substituted another word. The slow readers did not know the meaning of most of the words tested, whether the word was technical or not.

Table 6

Oral Reading Rates and Comprehension Levels
For a Sample of Company 11 BE/E Students

Student	Reading Rate (Words per minute)	Rated Comprehension
1	150	Excellent
2	100	Poor
3	100	Good
4	90	Poor
5	90	Good
6	65	Poor
7	65	Poor
Mean	94	

In comprehension testing, the words used in the text were used in the test. Each question was in a "wh" format (i.e., who, what, where, etc.). Comprehension was rated excellent if the student could immediately point to the relevant information in the passage and state the correct answer. Comprehension was rated poor if the student had to search through the passage, rereading it at least twice before he provided an answer. In locating the answer, the poor comprehenders generally read until they recognized a noun or noun-verb combination from the question. They then answered by reading aloud some portion of text surrounding the key words. Four of the seven students were rated as poor comprehenders.

BE/E Scores on the Electronics Basic Skills Test Battery

The scores made by BE/E students on the electronics basic skills test battery, administered at the time of the second interview, are given in Table 7. Since ASVAB scores were not available, selection of the USN students was not based on entry level scores. They were, however, at approximately the same point in training as the Company 11 students and they were behind their projected rate of progress.

Table 7

Performance of BE/E Students on the Electronics Basic Skills Test Battery

Test	BE/E Students			
	Company 11		USN	
	Score	S.D.	Score	S.D.
Reading-to-Learn	25%	16	31%	10
Reading-to-Do	65%	26	94%	14
Technical Vocabulary	43%	17	68%	16
General Vocabulary	42%	12	88%	13
Mathematics	29%	16	39%	15
Notetaking	7%	11	89%	16
Preparatory Technical Knowledge	47%	12	50%	21

Note. Ns were 18 for Company 11 and 12 for the USN cohort. "Score" is the mean percent correct.

Comments on BE/E School Findings

The test scores confirmed the conclusions drawn from the interview, that Company 11 students were comparable to the USN students in preparatory technical knowledge and approached comparability in mathematics and reading-to-learn. Large differences, ranging from 25 to 46 percent, were found in vocabulary skills and in reading-to-do. There was no significant time pressure on the reading-to-do test, yet Company 11 students found the answers to only five of eight factual questions in short electronics passages. These findings were consistent with the earlier comprehension test results. The

RSNF students clearly had considerable difficulty in locating factual information in their texts. In contrast, most USN students found the answer to all eight questions.

The greatest deficit was in notetaking--Company 11 students simply were not able to take notes.

Instructors judged Company 11 students better in basic skills and knowledge than previous companies. However, both students and instructors agreed that additional training was needed in reading comprehension and in the application of information.

A senior chief of the RSNF liaison office directed the development of an English-to-Arabic dictionary that included all BE/E technical terms. The dictionary does not give the strict Arabic equivalents, since these words are also technical words which the student is not likely to know. Rather, the definitions are in common sense terms. For example, "vacuum tube" is defined as a "main or center tube." The students indicated that the dictionary was very helpful and that it was used regularly by most students.

Audio-visual (A-V) material, if made available, could facilitate learning. Only one of the USN students was aware that A-V aids were available for all BE/E modules. Several instructors suggested that the availability of A-V material is not publicized because a student must be trained to use the A-V equipment. This information was obtained after the RSNF students had been interviewed, but it may be presumed that they were also unaware of the existence of A-V material. Training on the A-V equipment should be a part of FST-II.

It was anticipated that the students would have considerable difficulty with self-paced instruction because of the increased reading requirements and a lack of familiarity with the study demands of the system. However, the interviews did not reveal any problems unique to self-pacing. Indeed, self-pacing reduced the notetaking requirement, a skill in which the RSNF students were very deficient.

Fire Control Technician (FT) Class "A" School

FT Interviews

The first interview of the RSNF FTs was conducted while they were in BE/E school, as previously described. At the time of the second interview, only five Company 11 students had begun FT "A" school; two were in the first week of training and three were in the second week. The instructors felt that it was too early to judge the technical knowledge of the students but preliminary indications were that it was excellent. Mathematics skills also appeared to be adequate. The instructors saw problems in the ability of the students to keep up with the pace of instruction and to understand terminology. Overall, however, the students were judged superior to Company 10 students. One of the students in the second week was considered fully competitive with his USN classmates, outscoring many of them on the entry test and first quiz.

Although vocabulary and reading comprehension had been a problem in BE/E and were expected to be a problem in "A" school, students commented that their only problem was taking notes.

FT Scores on the Electronics Basic Skills Test Battery

The basic skills test battery was the same one used to test BE/E students. Two groups of USN students were tested: one just eligible for the school, and one in the middle range of eligibility scores. The results are given in Table 8.

Table 8

Performance of FT Students on the Electronics Basic Skills Test Battery

Test	Company 11		USN FT Students: Low-Eligibility		USN FT Students: Middle Eligibility	
	Score	S.D.	Score	S.D.	Score	S.D.
Reading-to-Learn	29%	11	50%	18	55%	14
Reading-to-Do	78%	9	93%	14	90%	17
Technical Vocabulary	58%	16	72%	16	84%	14
General Vocabulary	57%	28	78%	11	91%	11
Mathematics	38%	16	48%	12	50%	19
Notetaking	31%	27	95%	6	90%	23
Preparatory Technical Knowledge	67%	12	58%	16	64%	14

Note. Ns were 5 for Company 11, 16 for low-eligibility USN FTs, and 15 for the middle-eligibility USN FTs. "Score" is the mean percent correct.

On all but the reading-to-learn test, the Company 11 FTs had much higher scores than did the Company 11 BE/E students as a whole. This was expected, since FT is a very demanding rating that only the most able personnel are allowed to enter. While scoring higher than other Company 11 students, the FTs scored much lower than either group of USN FT students on all but the preparatory technical test.

The most significant deficiencies were in notetaking (59 percent below either USN group), general vocabulary, and reading-to-learn. In contrast, the Company 11 students were fully comparable to the USN students in preparatory technical knowledge and, in fact, scored a few points higher on this test.

Gunner's Mate (GM) "A" School

GM Interviews

The two GMs from Company 11 had only just begun GM "A" school at the time of the second interview and test session. For this reason, neither the students nor their instructors were interviewed. Both students were tested, however.

GM Scores on Electronics Basic Skills Test Battery

When compared with the scores made by Company 11 BE/E students as a whole, the scores of the two GM students were very low on all but the general vocabulary and notetaking tests (Table 9). Relatively low scores were expected, however, since the GM rating has one of the lowest aptitude requirements of all electricity/electronics ratings.

Table 9

Performance of GM Students on the Electronics Basic Skills Test Battey

Test	GM Students	
	Company 11 Score	USN Score
Reading-to-Learn	13%	21%
Reading-to-Do	50%	94%
Technical Vocabulary	20%	61%
General Vocabulary	65%	82%
Mathematics	8%	45%
Notetaking	50%	97%
Preparatory Technical Knowledge	39%	48%

Note. "Score" is the mean percent correct; because of the small populations, standard deviations were not calculated. Ns were two for Company 11 and eight for the USN sample.

The Company 11 GMs scored well below the USN GMs on all tests, with the largest deficiencies in reading-to-do, technical vocabulary, mathematics, and notetaking. The performance of the Company 11 GMs is expected to be impaired to the extent that these skills will be needed in follow-on schools.

Engineman (EN)

In the RSNF engineering pipeline, students progress directly from Propulsion Engineering Basics (PE) school, to Engineman (EN) "A" school, and then to a Class "C" school. The PE and the EN "A" courses are both self-paced and the expected completion times for Saudi students are 3 weeks in PE and 9 weeks in EN. EN "C" school is a 3-week group-paced course. The Company 11 EN students were first interviewed and tested during the last half of PE. The second interview and test session occurred at the end of EN "A" and the beginning of EN "C."

EN Interviews

Instructor comments were consistent across both interviews. Company 11 students were reported as being much better academically than Company 10 students. They appeared to be more motivated and more attentive, and they were scoring higher than those in previous companies. In the second interview, EN "A" school instructors reported that some of the RSNF students were doing better than USN students. The students stated in both interviews that the training was not too difficult. They said that two-thirds to three-fourths of the material in the PE and EN "A" schools repeated the curricula of the FST II and SDTT courses.

In the first interview, the instructors indicated that the Company 11 students were having difficulty only in vocabulary--both technical and general. In the second interview,

they reported student deficiencies in writing and "hands-on" experience. They reported that entry-level technical knowledge and speaking and understanding English were fully adequate.

Students indicated in the first interview that their primary problems were in understanding technical manuals, interpreting diagrams of valves, and vocabulary. In the second interview, the diagrams were no longer reported as a problem; the primary problems were technical vocabulary, use of conversion charts, and reading and understanding at the required speed. Students and instructors agreed in both interviews that mathematics was not required. Instructors, even at the "C" school level, stated that the level of mathematics represented in the diagnostic battery was not required.

EN Performance on Reading Comprehension Test

At the first interview and test session, the comprehension skills of five EN students were assessed by asking each one to read aloud a 150-word passage from his text and then to answer verbatim comprehension questions. The results (Table 10) parallel the findings for BE/E students. The range of reading speed is somewhat narrower than for BE/E, and the mean is slightly higher. Oral reading errors were comparable to those of the BE/E students. The student reading at 128 WPM could pronounce most words in the text and paused appropriately when reading. The students reading at 79 and 72 WPM made errors of the same type and about as often as the slow-reading BE/E students. Poor comprehension, as described earlier for the BE/E students, indicates extreme difficulty in finding answers to verbatim comprehension questions. The student reading at 72 WPM could not locate the answer to two or three verbatim comprehension questions. He simply could not comprehend the 150-word passage well enough to locate facts.

Table 10

Oral Reading Rates and Comprehension Levels
For a Sample of Company 11 EN Students

Student	Reading Rate (Words per minute)	Rated Comprehension
1	128	Good
2	108	Poor
3	106	Excellent
4	79	Poor
5	72	No comprehension
Mean	98.6	

EN Scores on Engineering Basic Skills Test Battery

The engineering basic skills test battery was administered to eight Company 11 students and a sample of USN students at the second interview and test session (Table 11). The USN students were divided into low, middle, and high groups on the basis of their eligibility for EN school.

Table 11

Performance of EN Students on the Engineering Basic Skills Test Battery

Test	Company 11 ENs		USN EN Students					
			Low-Eligibility		Middle-Eligibility		High-Eligibility	
	Score	S.D.	Score	S.D.	Score	S.D.	Score	S.D.
Reading-to-Learn	20%	23	71%	15	83%	16	95%	6
Reading-to-Do	42%	21	80%	28	89%	17	93%	10
Technical Vocabulary	46%	20	64%	19	76%	22	95%	8
General Vocabulary	36%	12	68%	17	83%	12	90%	8
Mathematics	15%	7	14%	9	16%	7	31%	22
Notetaking	21%	16	73%	33	72%	34	89%	20
Preparatory Technical Knowledge	35%	10	49%	7	53%	11	59%	12

Note. "Score" is the mean percent correct. Ns equaled eight for Company 11, twelve for the low-eligibility USN group, eight for the middle group, and seven for the high group.

Comments on EN School Findings

The interview and test data yielded inconsistent results. Interview data indicated that the students were doing well with no significant problems. The test data, however, indicated that there were significant deficiencies in all skills except mathematics. There are two possible explanations for this discrepancy. First, the tests may have been too difficult; that is, while Company 11 EN students scored below USN students, they may still have reached the threshold level required for successful school performance. The RSNF students made low scores on the notetaking test, for example, but the need for notetaking is minimal in a self-paced course. Except for notetaking, however, it is unlikely that the tests were too difficult--the materials were selected from the EN training curriculum, the tests were administered with a liberal time limit, and the questions were all factual and directly relevant to EN training.

The second explanation is that the students knew the EN curriculum well enough, from SDTT instruction, to succeed in EN "A" school despite their low scores on the basic skills tests. If this is true, their performance will be lower in EN "C" school, where all the material encountered will be new. None of the students had progressed far enough in EN "C" to test this hypothesis.

The Company 11 students were comparable to the low-eligibility USN group on the mathematics test, but scored well below this group on all other tests. The largest deficits were in reading-to-do, reading-to-learn, and notetaking.

An English-to-Arabic technical dictionary was developed for the propulsion engineering curriculum, but students reported that it did not include all of the words needed. Students reported no problems with self-study in either interview, although they disliked the emphasis placed on testing and getting through quickly--a characteristic of Navy self-paced instruction.

Operations Specialist (OS) Class "A" School

After FST-II and SDTT seamanship training, 14 students entered the Operations Specialist (OS) Class "A" school. Portions of this course are classified and not accessible to personnel without an American security clearance. Therefore, all-Saudi classes were convened and the classified material was deleted. The OSs were only interviewed and tested once.

OS Interviews

This was the only school at which Company 11 students were reported as being academically poorer than prior classes and as presenting significant disciplinary problems. Students were described as having little comprehension and minimal retention of reading assigned as homework. The instructor reported uncontrollable cheating on tests. Student strengths were in hands-on-work (i.e., practical examinations and plotting). Instructors felt that no math was required in OS school.

Students reported that they could not take notes fast enough and that their vocabulary and reading skills were inadequate. Notetaking was required both in class and in transcribing radio messages. The students indicated that language training stopped too soon; they believed it should have been extended through FST-II. Both students and instructors reported dissatisfaction with the all-Saudi classes. The instructors indicated that the RSNF students probably did not learn as much, or as fast, as they would have if there had been peer pressure from USN students.

The students and their instructors both felt that the all-Saudi classes might have contributed to the academic and disciplinary problems experienced by the RSNF students in OS "A" school.

OS Scores on Seamanship Basic Skills Test Battery

The Company 11 students were seriously behind in general vocabulary and they performed much more poorly than the USN students on the reading-to-learn, reading-to-do, notetaking, and technical tests (see Table 12).

Comments on OS School Findings

Both students and instructors reported significant academic difficulties, especially in reading and notetaking. The test data confirmed these deficiencies, with Company 11 students scoring 40 or more percentage points below the USN students on four of five language-related tests.

The RSNF students reported that the content of FST-II and SDTT did not prepare them for OS "A" school. They had heard from other students that the preparatory training would help those students who continued on to the quartermaster (QM) and signalman (SM) schools. This comment, if accurate, indicates that the FST-II and SDTT training given to seamanship students did not generalize to OS "A" school, either because the content of the OS and QM training is too disparate, or because the preparatory training was unnecessarily specific.

The length of the SNEP training pipeline precludes a preparatory course in the specific factual knowledge required in all the follow-on courses. If specific "A" school knowledge requirements are emphasized, then eventually students will encounter a school or set of topics not covered in the preparatory course and the learning difficulties

Table 12

Performance of OS Students on the Seamanship Basic Skills Test Battery

Test	OS Students			
	Company 11		USN	
	Score	S.D.	Score	S.D.
Reading-to-Learn	41%	15	92%	12
Reading-to-Do	28%	18	68%	17
Technical Vocabulary	34%	17	37%	16
General Vocabulary	39%	15	83%	10
Mathematics	15%	10	15%	13
Notetaking	15%	18	58%	24
Preparatory Technical Knowledge	33%	6	52%	8

Note. "Score" is the mean percent correct. Ns were 13 for Company 11 and 6 for the USN group.

reported in the OS "A" school will occur. Thus, the FST and SDTT curricula must focus on generalizable learning skills and on concepts that have wide applicability in follow-on training. When new topics are encountered, the students will have the skills to master the content.

DISCUSSION

The FST and SDTT programs were designed to give Saudi students the skills they would need in their follow-on training. Despite plans for a balanced approach, the preparatory instruction for Company 11 was primarily content instruction. All of SDTT, and two thirds of the time spent in FST-I, was devoted to technical or pretechnical instruction. Seventy to 86 percent of the instruction in the FST-II strands had as the primary objective the acquisition of technical knowledge. Thus, over 80 percent of the combined FST-SDTT instruction time was devoted to technical learning with less than 20 percent left for literacy and learning skills. Why this occurred is unclear. It may have been simply that the content knowledge deficiencies were so easily identifiable and so great relative to the learning strategy requirements that content instruction simply "won out" when curricular decisions were being made.

Performance on the basic skills test batteries was consistent with the distribution of instructional time in FST and SDTT. In all strands, the greatest comparability to USN students was on the test for knowledge of technical facts. In two of the five schools, Company 11 students equaled or exceeded the performance of the USN group. In contrast, their fact-finding and notetaking skills never approached those of the USN students.

The emphasis placed on learning technical facts sometimes resulted in excellent performance in the follow-on schools, but only so long as the same topics were being

covered and the instruction was at the recall recognition level. For example, students in the EN "A" and BE/E schools were learning technical facts at the time of the first interview and test session. The topics they were studying had been covered in FST and SDTT. The students, in turn, reported, "come back when it's harder . . . we had all of this before." The students were indeed doing very well; their instructors rated them "very good" and they were progressing faster than had been expected.

When the topics had not been covered in FST or SDTT, or when application of knowledge was required, performance was at a much lower level. Students in seamanship reported that the FST and SDTT courses did not prepare them for "A" school; that is, they did not address specific OS technical topics. These students were reported by the OS instructor as being no better than those in prior classes. BE/E students reported that they had the most difficulty with the one module not covered in FST or SDTT.

The effects of the lack of learning strategies were indicated by the inability of BE/E students to apply factual knowledge. Both the amount of time to complete a module and the error rate on the mastery examination increased dramatically when the requirement changed from fact learning (Modules 1 to 14) to the application of factual knowledge (Modules 15 to 25).

CONCLUSIONS

1. The FST and SDTT programs improved the performance of engineering and electronics students in the early phases of follow-on schooling and, in some instances, resulted in full comparability with USN students. The performance of RSNF students in OS "A" school, however, was not improved.

2. The early "A" school successes seem to have been due to the preteaching, in FST and SDTT, of the facts and procedures taught by the schools. Performance declined when new learning was required or when generalization and application of facts was required.

3. The primary student deficits were in the learning and literacy skills associated with notetaking and reading.

4. The RSNF students did not encounter unique problems in self-study. They neither favored self-study nor did they view it as something to avoid. Self-study had the advantage, for poor note-takers, of reducing the requirement for taking notes.

5. The all-Saudi classes were viewed as detrimental to learning by both instructors and students. The forming of all-Saudi classes in OS "A" school, while necessary because of security requirements, very likely contributed to the poor performance of the seamanship OS students.

RECOMMENDATIONS

The revisions called for below will require a major curiculum redesign effort. The seamanship strand will require the greatest revision, potentially an entire rewrite, since these students: (1) were reported as least improved (if improved at all) in "A" school performance; and (2) showed the greatest deficiencies in basic skills and knowledge relative to the USN comparison group. The specific recommendations to PM-5 are as follows:

1. Since course length is fixed, curricula revisions should begin with the elimination of technical topics that are not related to other topics in follow-on courses. Instruction on topics used repeatedly in the follow-on instruction could then be increased.

2. For all strands, the extent to which FST instruction will generalize to new learning situations should be increased. The emphasis of the instruction should be on solving problems and applying knowledge to new topics and situations. More time should be devoted to skills that have a wide range of applicability (e.g., completing laboratory sheets and other forms, following written procedures, troubleshooting, reading meters, taking measurements, taking notes, and reading instructional texts).

3. Instruction in notetaking and reading should be increased. This instruction should emphasize rapid locating and abstracting of information from text and lectures.

The test and interview data indicated that all students were extremely deficient in notetaking and this deficiency put them at a significant disadvantage in lecture courses. Strategies for identifying key points and for categorizing and identifying relationships can be taught in the context of notetaking. The problem is probably not in writing, but in knowing what to write.

In reading, the RSNF students' greatest problem was locating information rather than recalling facts from a passage. They typically searched for the answer to an oral question by rereading word for word from the beginning. There are also significant deficiencies in their technical and general vocabularies. To teach all relevant vocabulary would be impossible. Rather, the instructional approach should focus on strategies for rapidly determining the meaning of a word through context or by using a dictionary. The relevance of learning strategies (e.g., search techniques, identifying relationships, and generalizing) is obvious in both of these reading tasks.

4. Instruction in learning skills and strategies should be increased by embedding them in the technical problem solving objectives and in the instruction on basic literacy skills.

The evaluation data consistently pointed to a need for an increased emphasis on learning strategies and literacy skills. Since the preparatory training is of fixed duration, there must be some adjustment in the technical instruction. It does not necessarily mean a drastic reduction in technical instruction, however. The shift in emphasis could be accomplished in large measure by changing the focus of instruction from teaching a wide range of facts to teaching concepts and problem-solving techniques. Learning skills of categorizing, generalizing, using analogies, and reconfiguring information through flow charting and graphing could be taught in the context of solving technical problems. Identifying key points, mnemonic techniques, study skills, skimming, and other strategies for abstracting information could be taught in the context of literacy instruction.

5. Given the limited time available for preparatory instruction, instructional aids should be utilized whenever possible to reduce the basic skill requirements. The English-to-Arabic dictionaries should be incorporated into the FST and SDTT curricula and the dictionary development effort should be expanded to cover all follow-on schools. Using the dictionaries during preparatory instruction could reduce vocabulary training requirements. In expanding the dictionaries, SNEP students could be used to identify the difficult words and experienced RSNF chiefs could then provide simplified Arabic definitions. The dictionaries should be hardbound to withstand up to a year of heavy use.

To reduce notetaking requirements, RSNF students should be provided with cassette-type record/playback machines to record "A" school lectures.

6. The use of self-study instructional procedures should be expanded. A change in this direction is not possible for training in the United States but should be considered for the Jubail Training Center. Self-paced courses require more reading, but less notetaking, than group-paced courses do. If the difficulty of the reading material can be controlled, the self-pacing approach is preferable in terms of the basic skills requirements. There are clearly additional considerations, including training philosophy, which are involved in considering self-paced versus group-paced instruction. RSNF students in the self-paced BE/E and EN "A" schools reported that the self-paced approach was acceptable. No culture-specific problems were evident in these courses.

7. At the end of FST-II, electronics students should be taught how to use the BE/E school's audio-visual equipment. This training should include a visit to BE/E school.

8. The mathematics requirements for the engineering and seamanship strands should be reviewed to determine whether the FST-II mathematics instruction should be eliminated or reduced in these strands.

Mathematics instruction is the only basic skill where a reduction in instructional time is required. In all but GM "A" school, no more than 10 percentage points separated the performance of Company 11 and USN students on the mathematics subtest. Mathematics was never reported as a problem. In the EN and OS "A" schools, the instructors and students reported virtually no mathematics requirement beyond measurement. The mathematics currently taught to these students is therefore not necessary.

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